

Nutritional Quality of American Children's Diets

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Excess total and saturated fat, excess sodium, and insufficient dietary fiber are three dietary problems facing children as well as adults in the United States. These dietary problems are associated with obesity, heart disease, and some forms of cancer. Additionally, the *Third Report on Nutrition Monitoring in the United States*, which synthesizes data on nutritional status from a wide range of Federal surveys, has identified low intakes of iron and calcium as a public health concern. The widespread consumption of these nutrients at lower-than-recommended levels, combined with clinical and biochemical evidence of associated adverse health effects, causes concern because evidence suggests that certain dietary patterns established in childhood could lead to chronic diseases or health conditions during adulthood.

Healthy People 2000, National Health Promotion and Disease Prevention Objectives, lists goals for improving the nutritional status of children and adolescents, including reducing obesity, growth retardation, and dietary fat intake; increasing calcium and iron intakes; enhancing nutri-

tion education from preschool through grade 12; and improving school meals with menus consistent with nutrition principles in the *Dietary Guidelines for Americans*. Understanding children's current dietary patterns is a step in achieving these goals.

This article looks at children's meal and snack patterns and their intakes of food calories, total fat, saturated fat, cholesterol, fiber, calcium, iron, and sodium. Data from USDA's 1989-91 Continuing Survey of Food Intakes by Individuals (CSFII) provided the basis for the findings. The focus of this article is on children and adolescents between the ages of 2 and 17 (hereafter called children), who (themselves or their parents) reported dietary intake information over a 3-day survey period.

The CSFII collects information on what, when, and where Americans eat and how much they eat using a daily diary of dietary recall. USDA's Agricultural Research Service (ARS) maintains a nutrient database, which is used to calculate the amount of nutrients in each food eaten. Several studies have shown that there is significant underreporting in dietary recall data. Thus the data represent a lower limit on the amount of food and nutrients consumed. Therefore, the degree of overconsumption of certain nutrients (such as sodium) likely would

be understated while the degree of underconsumption of other nutrients (such as fiber) might be overstated.

Older Children Ate Fewer Meals and Snacks Each Day

Children in the survey reported eating an average of 3.8 times a day—2.7 meals and 1.1 snacks. More than half of all children ate three meals each day, and the average number of meals decreased with age. Preschoolers (aged 2-5) had the largest numbers of meals (2.8) and snacks (1.3) per day (fig. 1). Female adolescents (aged 12-17) ate an average of 2.5 meals and 1.0 snack per day—the fewest occasions among the four age/gender groups specified in this study.

Meals can be classified on the basis of time of eating or name of occasion. It is common to describe the first eating occasion of the day as breakfast. But brunch, lunch, dinner, and supper are used interchangeably, due to regional and cultural differences. Meals are categorized here as morning, midday, and evening meals according to the self-reported eating occasion and time. Morning meals include breakfast as well as brunch eaten before 10 a.m.; midday meals include brunch eaten between 10 a.m. and 3:30 p.m. as

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well as lunch, dinner, or supper eaten before 3:30 p.m.; and evening meals include brunch, lunch, dinner, or supper eaten after 3:30 p.m. Snacks can be eaten at any time, and they are treated as a separate category. This categorization enables us to find out the frequency of skipping

(or eating) a particular meal category and the distribution of caloric and nutrient intakes across meal categories.

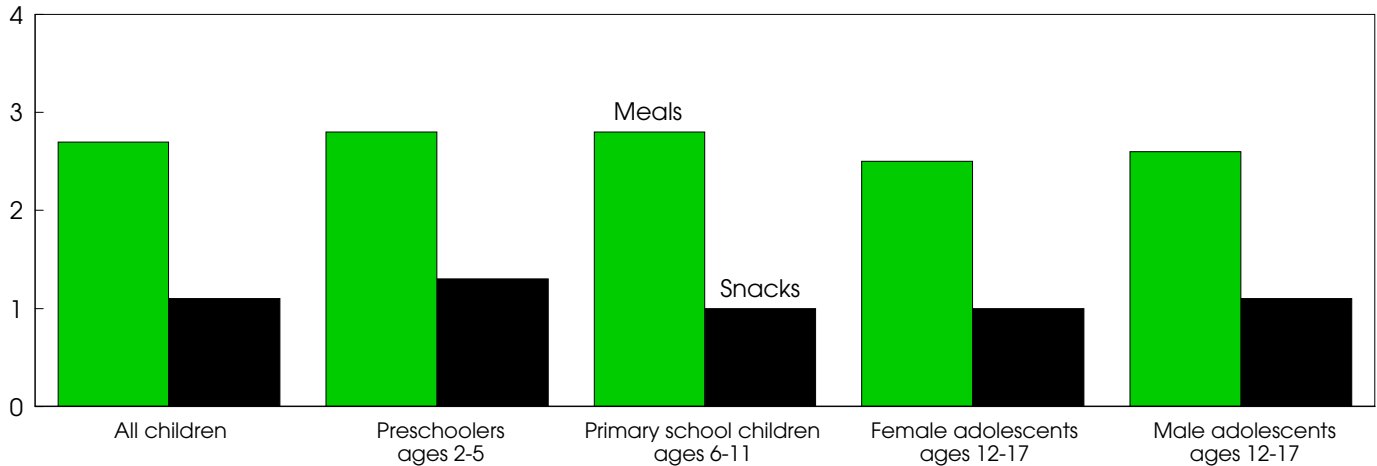
Different meal patterns emerge as children get older. For example, older children skipped meals more often than younger children (fig. 2).

The percentage of children skipping morning meals increased with age, from 5-6 percent among children aged 2-11 to 20-24 percent among adolescents (12-17 years in age). About 10 percent of children aged 2-11 skipped midday meals, as did 17 percent of adolescents. Relative to

Figure 1

Older Children Ate Fewer Meals and Snacks Than Did Younger Children

Number of eating occasions

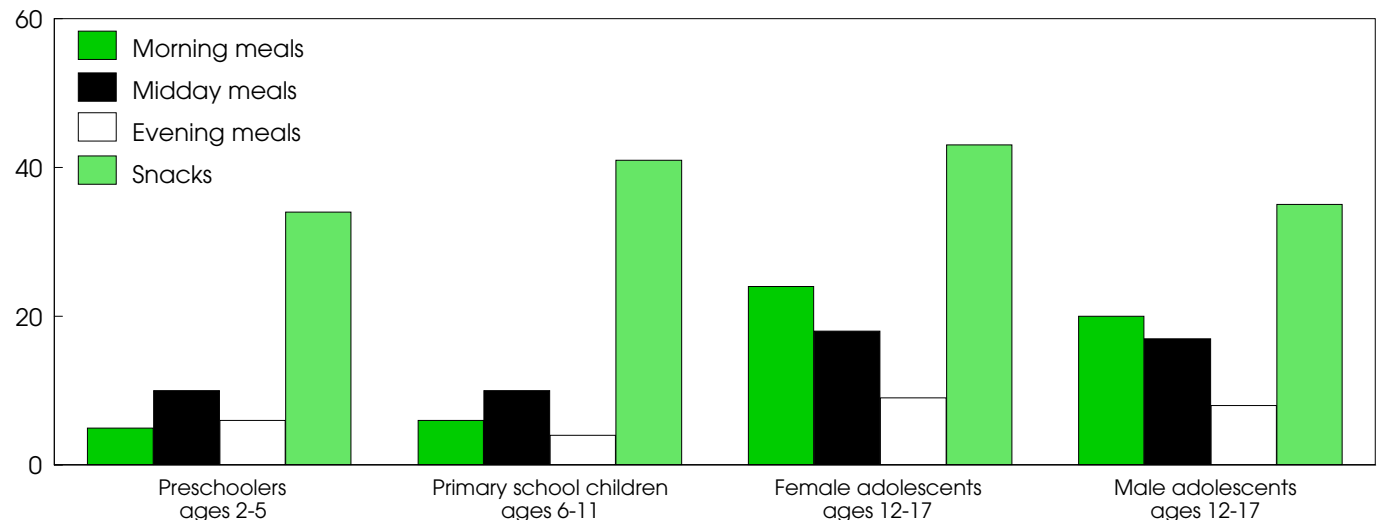


Source: CSFII 1989-91, 3-day weighted averages.

Figure 2

Older Children Skipped Morning Meals Frequently

Percent of children skipping meals



morning and midday meals, a smaller percentage of adolescents skipped evening meals. Still, adolescents were more likely to skip evening meals than were children aged 2-11 (8-9 percent versus 4-6 percent). Most children supplemented meals with snacks, but not every child snacked—34 percent of preschoolers, 41 percent of children aged 6-11, 35 percent of male adolescents, and 43 percent of female adolescents did not report eating any snack.

CSFII respondents also reported whether the amount of food consumed that day was unusual. On average, only 14 percent of children consumed unusual amounts of food on a given day. The most common reasons for such eating were not hungry/not too hungry (21 percent of unusual days), too little time/too busy (20 percent), and sick (19 percent).

Caloric Intakes Below Recommended Levels, Yet Obesity a Concern

The healthy body needs energy for metabolic processes, to support physical activity and growth, and to maintain body temperature. The National Research Council's Recommended Energy Allowances (REA) are set according to age, physical activity, body size, and gender. The 1989 average daily REA's are 1,300, 1,800, and 2,000 calories for children aged 1-3, 4-6, and 7-10, respectively. The average REA's for males aged 11-14 and 15-18 are 2,500 and 3,000 calories, respectively. The REA for females aged 11-18 are 2,200 calories on average.

In the 1989-91 CSFII survey, children's intakes averaged 1,781 calories per day—only 88 percent of their average 1989 REA. Both daily caloric intakes expressed as percentage of REA and the percentage of

children meeting their REA's decreased with age (table 1). Preschoolers, on average, obtained 92 percent of the REA, and about 34 percent of them met their recommended level. Female adolescents reached 82 percent of the REA, and only 22 percent of them met the recommendation.

While the CSFII data indicate that many children had caloric intakes below the recommended level, obesity has become a significant public health problem for both adults and children in the United States. For example, the prevalence of overweight among children and adolescents increased from 5 percent in the 1960's to 11 percent in 1988-91, according to the National Center for Health Statistics. This inconsistency could be caused, at least partially, by the fact that dietary recall data are subject to underreporting. Furthermore, factors in addition to caloric intake could have contributed to the increased prevalence of obesity. There is evidence to suggest that low physical activity (notably watching television), and hence decreased energy expenditure, has contributed to overweight.

Too Much Fat, Especially Saturated Fat

Beginning in 1990 and continuing in 1995, the *Dietary Guidelines for Americans* recommend people age 2 and over consume no more than 30 percent of calories from fat and less than 10 percent of calories from saturated fat. The Daily Reference Value, established for use on the nutrition facts label now required on most packaged foods, for cholesterol is less than 300 milligrams (mg). Over the past few decades, Americans have made substantial progress in reducing fat intakes in their diets, in part due to heightened dietary concerns and increased availability of lower fat products in the market. The percentage of calories from fat in America's diet has been reduced

from 40 percent in 1977/78 to 34-35 percent in 1989/91—but it is still above the recommended level.

The 1989-91 CSFII data reveal that most children met the recommendation for cholesterol, but many were far above the guidelines for total or saturated fat. With an average daily cholesterol intake of 236 mg, 77 percent of children met the recommendation of less than 300 mg (table 1). Since older children ate more, they tended to have higher cholesterol intakes. Preschoolers had average cholesterol intakes of 196 mg per day, and 86 percent of them met the recommendation. Cholesterol intakes increased with age: 236 mg for children aged 6-11 (77 percent met the recommendation) and 303 mg for male adolescents (64 percent met the recommendation).

The cholesterol-to-calorie densities (the amount of cholesterol per 1,000 calories) in children's diets were 133 and 132 mg per 1,000 calories for females and males, respectively. Average REA's are 2,200 and 2,900 calories for female and male adults aged 19-50, respectively. Dividing the recommended limit of 300 mg of cholesterol per day by these average REA's, it can be seen that to meet the guideline for cholesterol intake, women aged 19-50 should consume no more than 136 mg of cholesterol per 1,000 calories and men aged 19-50 no more than 103 mg of cholesterol per 1,000 calories. Therefore, male children have a more urgent need to modify their eating habits as they grow older in order to meet the recommended cholesterol intake guideline during adulthood.

While caloric intakes varied substantially by age and gender, the share of calories from total fat and saturated fat was fairly consistent across age and gender, differing by less than 1 percentage point for both total and saturated fat among the four age/gender groups. The chil-

dren in the survey consumed an average of 34 and 13 percent of calories from total fat and saturated fat, respectively. About 22 percent of the children met the guideline of 30 percent or less calories from total fat, and only 13 percent of the children

met the guideline of less than 10 percent of calories from saturated fat.

The percentage of children meeting the fat guidelines varied across age/gender groups. Male adolescents were the least successful in

meeting the guidelines, with only 11 percent meeting the saturated fat guideline and 17 percent meeting the total fat guideline. Preschoolers did the best in meeting the guideline for total fat with 26 percent of them meeting the guideline. Female ado-

Table 1

USDA Survey Suggests Children's Diets on Average Are High in Fat and Sodium and Low in Fiber and Cholesterol

Calories/nutrient	Unit	All children	Preschoolers ages 2-5	Children ages 6-11	Adolescents ages 12-17	
					Females	Males
Daily intakes						
Total calories consumed ¹	calories	1,781	1,395	1,796	1,799	2,349
Protein	calories	267	213	267	271	352
Carbohydrate	calories	900	710	911	904	1,174
Total fat	calories	614	473	617	625	823
Saturated fat	calories	34.2	33.7	34.3	34.3	34.5
Other nutrients consumed:						
Cholesterol	milligrams	236	196	236	234	303
Calcium	milligrams	902	800	923	820	1,103
Dietary fiber	grams	11.7	9.1	12.0	11.8	15.3
Iron	milligrams	12.8	10.4	12.8	12.6	16.8
Sodium	milligrams	2,948	2,274	2,947	3,057	3,926
Percent of calories from:						
Total fat	percent	34.2	33.7	34.3	34.3	34.5
Saturated fat	percent	13.1	13.3	13.2	12.7	12.9
Intake as percent of recommended levels ²						
Food energy	percent	88	92	89	82	86
Total fat	percent	114	112	114	114	115
Saturated fat	percent	130	133	132	127	129
Cholesterol	percent	79	65	79	78	101
Calcium	percent	97	100	109	68	92
Dietary fiber	percent	88	108	90	61	79
Iron	percent	114	104	123	84	140
Sodium	percent	123	95	123	127	164
Percent of children meeting the recommended intake level						
Food energy	percent	30	34	33	22	26
Total fat	percent	22	26	21	21	17
Saturated fat	percent	13	14	11	19	11
Cholesterol	percent	77	86	77	76	64
Calcium	percent	43	47	53	16	38
Dietary fiber	percent	32	53	30	11	24
Iron	percent	53	48	64	21	71
Sodium	percent	34	60	30	28	10

Notes: ¹Total calories are the sum of calories from protein, carbohydrate, and fat intakes. Each gram of protein, carbohydrate, and fat provides 4, 4, and 9 calories, respectively. ²The recommended intakes used in this study are: the National Research Council's Recommended Energy Allowances (REA) for energy and Recommended Daily Allowances (RDA) for calcium and iron; the FDA's Daily Reference Value for sodium (2,400 mg) and cholesterol (less than 300 mg); and the American Health Foundation's "age plus 5" for fiber. Source: 1989-91 CSFII, 3-day weighted averages.

lescents did the best regarding saturated fat, with 19 percent of them meeting the guideline.

Too Much Salt and Too Little Fiber in Children's Diets

Sodium has an important role in the body, but most Americans—including children—consume more sodium than is needed. Children in the CSFII survey consumed an average of 2,948 mg of sodium per day, above the Daily Reference Value (DRV) of 2,400 mg, which appears on the Nutrition Facts label on most foods. This DRV does not change across age-gender groups. It should be pointed out that the overconsumption of sodium is probably higher than is indicated by the CSFII data, because salt added at the table is not included in CSFII intake data.

Sodium intakes increased with age, from 2,274 mg per day for preschoolers, to 2,947 mg for children 6-11 years old, to 3,057 mg for female adolescents, and to 3,926 mg for male adolescents (table 1). Consequently, the share of children meeting the recommended sodium intake of 2,400 mg or less decreased with age, declining from 60 percent among preschoolers to 10 percent among male adolescents.

The sodium-to-calorie densities were 1,669 and 1,644 mg per 1,000 calories, respectively, for females and males between the ages of 2 and 17. Dividing the recommended limit on sodium intake of 2,400 mg by the average REA's for women and men aged 19-50, it can be seen that, to meet the recommendation, women and men between the ages of 19 and 50 need to consume no more than 1,090 and 828 mg of sodium per 1,000 calories, respectively. Therefore, major dietary changes have to occur for children in order for them to be able to meet the recommended limit on sodium intake as adults.

Dietary fiber has important health benefits in childhood, especially in promoting normal laxation. In addition, consumption of foods high in fiber may help reduce the risk of heart disease and some cancers. The National Cancer Institute recommends a daily fiber intake of 20 to 30 grams for adults. According to the Child Health Center of the American Health Foundation, a reasonable goal for dietary fiber intake during childhood and adolescence may be approximately equivalent to the child's age plus 5 grams per day. This "age plus 5" guideline results in a gradual increase of fiber intake over time, with 17-year-olds eating 22 grams per day, an amount also within the range recommended by the National Cancer Institute.

Despite intensive efforts by nutritionists, food manufacturers, and others in the health care industry to spread the word about the virtues of fiber, children's and adults' intakes remain below the recommended levels. In the 1989-91 survey, children consumed 11.7 grams of fiber per day, or 88 percent of the "age plus 5" recommendation. Both fiber intake as a percentage of the "age plus 5" recommendation and the percentage of children meeting the recommendation decreased with age. However, more than half of preschoolers exceeded the "age plus 5" recommendation, with average intakes 8 percent above the recommended level. Children aged 6-11 had an average fiber intake of 12 grams per day, or 90 percent of the "age plus 5" level, and 30 percent of them met the recommendation. About 11 percent of female adolescents met the "age plus 5" recommendation, with an average intake of 11.8 grams per day (61 percent of the recommended level).

Children, Especially Teenage Girls, Need More Iron and Calcium

Iron deficiency is the single most prevalent nutritional deficiency in the United States. Iron deficiency has been shown to cause functional impairments in work performance, behavior and intellectual development, and resistance to infections. Health care experts have identified iron as a priority category for nutrition monitoring. Young children, adolescents, and women of child-bearing age are considered to be the groups at the greatest risk of iron deficiency. The 1989 daily iron RDA's are 10 mg for children aged 1-10, 12 mg for males 11-17 years old, and 15 mg for females 11-17 years old.

In the 1989-91 CSFII survey, less than half the preschoolers met their iron recommendations (table 1). However, the majority of children 6-11 years old (64 percent) and male adolescents (71 percent) met their iron recommendations, and their average intakes exceeded their respective recommendations.

Only 20 percent of female adolescents met their RDA for iron, and their average intake fell below the RDA by 16 percent. There are two factors associated with the low iron intake in female adolescents' diets. Compared with other children, female adolescents have the highest iron recommendations relative to the recommended energy allowances and they have the highest tendency in skipping morning meals (24 percent of them skipped morning meals on a given day) (fig. 2). The CSFII 1989-91 data show that morning meals had the highest iron and calcium densities among meals and snacks. For example, the iron-to-calorie density in morning meals was 12.7 mg per 1,000 calories for all children, compared with 5.7 mg in

midday meals, 6.4 mg in evening meals, and 4.5 mg in snacks.

The RDA's are recommendations for usual intake. Nutrient intakes vary from day to day, and a lower-than-recommended intake on a given day does not necessarily indicate a poor diet. Moreover, the RDA's are recommended allowances, not requirements—they are intentionally set high to cover the needs of almost everyone in a given age-sex group. Therefore, nutrient intakes below the RDA do not necessarily mean that physiological nutrient deficiencies exist. Nevertheless, such a high prevalence of low intakes indicates a need for dietary guidance and improvement.

Calcium is essential in the formation of bones and teeth and in the maintenance of bone strength. Low calcium intake is one of several factors associated with osteoporosis, a loss of bone mass that increases sus-

ceptibility to fractures (see "Osteoporosis-Related Hip Fractures Cost \$13 Billion to \$18 Billion Yearly," elsewhere in this issue). The *NIH Consensus Statement* on optimal calcium intake suggests that higher intakes of dietary calcium could increase peak bone mass during adolescence and early adulthood and delay the onset of bone fractures later in life. The calcium RDA is 800 grams for children up to 10 years old and 1,200 grams for older children.

The CSFII data suggest that adolescents, especially females, need to consume more calcium. Male adolescents had a daily calcium intake of 1,103 mg (92 percent of the RDA), and 38 percent of them met the recommendation. Female adolescents had an average calcium intake of only 820 mg per day (68 percent of the RDA), and 16 percent of them met the RDA. The calcium-to-calorie

density in the diet of female adolescents was 456 grams per 1,000 calories, which was 16 percent below the average target of 545 grams (1,200 grams divided by the average REA of 2,200 calories). Among children, female adolescents had the highest tendency to skip morning meals, which had a calcium-to-calorie density of 731 mg per 1,000 calories, compared with 502 mg in midday meals, 414 mg in evening meals, and 437 mg in snacks.

Among common foods, milk and cheese are rich sources of calcium. The CSFII data showed that as children started secondary schools, they curtailed drinking milk as a beverage from more than 11 cups in 3 days among children aged 6-11 to fewer than 9 cups among male adolescents and to slightly more than 6 cups among female adolescents. In addition to milk and dairy products, foods rich in calcium include dark-

Diets of Teenage Girls—a Cause for Concern

Analysis of USDA's food consumption survey data (CSFII 1989-91) indicates problems about the diets of teenage girls. Those aged 12-17 report diets that over a 3-day period do not, on average, meet their RDA's for iron and calcium—two nutrients of current public health concern. In addition, their average intakes of five other essential nutrients—vitamin A (retinol equivalents), vitamin E, magnesium, phosphorus, and zinc—fail to meet their RDA's.

Some possible explanations may be found in their food choices. Almost one-third (30 percent) of all teenage girls reported eating no fruit or fruit juice over the 3-day survey period, while 18 percent drank no milk—the major source of calcium in the U.S. food supply. Although a higher proportion of teenage girls ate vegetables, they tended not to choose the more nutrient-dense types, such as dark-green and deep-yellow vegetables. Only 15 percent

ate dark-green vegetables and only 17 percent ate deep-yellow vegetables during the survey period.

Part of the reason for the nutritional problems found with diets of teenage girls may also be their low reported energy intakes. On average, girls 12-17 years old reported consuming 82 percent of their average Recommended Energy Allowance.

Although dietary recall data may underestimate calorie levels due to underreporting, there is reason to believe that teenage girls may seek to restrain their food intake inappropriately. Body weight and body image are major preoccupations of many teenage girls and may lead to weight-loss dieting, even when it is not indicated, or to the use of extreme weight-loss methods that may jeopardize their dietary status. The National Adolescent Student Health Survey, conducted in 1987-88, found that about 60 percent of adolescent girls dieted during the past year. Of those girls who had dieted, about

half reported fasting, 19 percent used diet pills, and 13 percent reported vomiting to lose weight.

These problems are of particular concern because the teen years may have a lasting impact on the health status of young women. Low calcium intakes may have especially serious long-term consequences. The National Academy of Sciences recommends a relatively high dietary allowance of calcium for teenage girls—1,200 mg per day—because this is a period in which peak bone mass develops. Adequate calcium intake during these years may help prevent osteoporosis in later life.

Given the problems with the diets of teenage girls and the serious consequences these problems may have, nutrition education and promotion is indicated. To be effective, such education should help girls to balance their preoccupation with weight and body image with selection of a nutritious diet.

Snack Ideas

Many people view snacking as a bad habit, but snacks can be an important part of a child's diet. Very young children usually can eat only small amounts of food at each meal, so snacks help them meet their needs for energy and nutrients. Snacks are also an important part of the diets of older children and teens. Planning healthy snacks with children can be a good way of helping them learn about nutrition. Some snack ideas include:

Raw Vegetables

Children who do not like cooked vegetables or salads often like cut-up raw vegetables that can be eaten as finger foods, such as carrots, broccoli florets, cucumber, slices of zucchini or yellow squash, green or red pepper strips, green beans, and cauliflower. Dips are popular and can encourage vegetable consumption. Salsa makes a tangy, lowfat dip that is also a source of vitamin C. Or lowfat cottage cheese

mixed in a blender or plain lowfat yogurt can be used as a base for dips.

Fruits

Sliced or served whole, fresh fruits like apples, bananas, berries, grapes, melon wedges, peaches, pears, or pineapples make a healthful snack. Fruits can be used as creative alternatives to other snacks. For example, fruits can be frozen, such as a banana on a stick for a "healthy-sicle." A fruit cup can be dressed with cheese slices, or fruit wedges can be made into a "sundae" with vanilla yogurt. Fruit pops are made by combining undiluted fruit juice concentrate with lowfat yogurt and freezing in popsicle trays. Dried fruits like raisins, peaches, and apricots can be good alone or with nuts or unsalted pretzel sticks as a "trail mix" type snack (nuts and seeds should not be given to very young children who may have difficulty chewing them).

Grains

Whole-grain crackers go with cottage cheese, peanut butter, or a lowfat bean dip. Graham crackers or lowfat cookies like gingersnaps complement applesauce and milk. Muffins and quick breads—like blueberry muffins or banana bread—can be served with fruit juice or milk.

Mini-Meals

Hungrier children may want more substantial snacks. Healthful mini-meals curb hunger without harming the diet. Examples include mini-pizzas from an English muffin topped with tomato sauce and lowfat mozzarella cheese, or a peanut butter and banana sandwich on whole wheat bread served with a glass of milk. Other choices include tuna salad made from water-packed tuna and lowfat mayonnaise-type salad dressing on whole wheat bread, and a quesadilla (melted cheese on tortilla) with salsa. Serve with milk, fruit juice, or a vegetable juice (like tomato juice).

green leafy vegetables and certain canned fish (with soft bones), tofu (processed with calcium sulfate), and tortillas (made from lime-processed corn).

What Does the Future Hold?

These findings suggest there are several shortcomings in children's diets. Iron and calcium have been identified as "problem nutrients" in children's diets. The CSFII data indicate that many children failed to meet their iron or calcium RDA's. Low intakes of iron and calcium are particularly prevalent among female adolescents, with only 21 and 16 percent of them consuming their RDA's for these nutrients. Female adolescents are especially at risk for at least three reasons: they ate the smallest number of meals and snacks, they drank the least amount of milk as a beverage, and they had

a high tendency to skip morning meals that are relatively rich in iron and calcium (see box on additional concerns about diets of teenage girls).

Insufficient dietary fiber, excess sodium, and excess total and saturated fat are three dietary problems facing children as well as adults in the United States. The CSFII data reveal an emerging problem of insufficient fiber intake when children reach school age, and the problem continues into adulthood. Children eat more as they grow up, and hence increase their sodium intakes. Excess sodium intake also becomes a problem when children reach school age, and the problem worsens among older boys. While energy intakes vary greatly among children, the percentage of calories from total fat and saturated fat are remarkably constant among children as well as adults. Obviously, remedial actions to correct these dietary problems

need to start early in childhood. The commonality in these dietary problems between children and adults points out the possibility that an improvement in adults' diets would set the stage for a better diet among children.

Snacking has become popular among children. However, according to a study by USDA's Center for Nutrition Policy and Promotion, children do not eat sufficient amounts of fruits and vegetables. Since fruits and vegetables are natural and convenient choices for snacks, promotion of fruits and vegetables as snack foods seems to be a promising strategy for increasing fiber and reducing fat and sodium in children's diet. Healthy snacks can improve a child's diet, and participating in fixing snacks can be a good way for children to learn about nutrition (see box for tips on healthy snacks).

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